WHAT IS CLAIMED IS:

1. A method for determining a location of a peak of a correlation function generated by comparing a first high-spatial-frequency image to a second high-spatial-frequency image, the correlation function having a regular background portion and a peak portion, the method comprising:

comparing a first high-spatial-frequency image to a second high-spatial-frequency image to determine at least one correlation function value for a set of at least one sparsely distributed correlation function value point of the correlation function; and

analyzing at least one of the at least one correlation function value to identify at least one correlation function value point that lies within the peak portion.

2. The method of claim 1, wherein analyzing the at least one of the at least one correlation function value comprises comparing at least one of a) the at least one of the at least one correlation function value and b) a determined value based on at least two of the at least one correlation function value to at least one value characterizing the regular background portion of the correlation function.

3. The method of claim 2, wherein the determined value based on at least two of the at least one correlation function values is a slope.

4. The method of claim 2, wherein the at least one value characterizing the regular background portion of the correlation function comprises at least one of an average correlation function value characterizing the background portion, a maximum correlation function value characterizing the background portion, a minimum correlation function value characterizing the background portion, a maximum slope value characterizing the background portion, and a minimum slope value characterizing the background portion.

5. The method of claim 4, wherein the peak portion of the correlation function comprises a positive-going extremum, and the at least one of the at least one correlation function value is compared to a maximum correlation function value characterizing the background portion.

6. The method of claim 4, wherein the peak portion of the correlation function comprises a negative-going extremum, and the at least one of the at least one correlation function value is compared to a minimum correlation function value characterizing the background portion.

7. The method of claim 2, wherein comparing the at least one of the at least one correlation function value to at least one value characterizing the regular background portion of the correlation function comprises determining a difference between at least one pair of correlation function values, and determining if the difference exceeds an established threshold value for the difference.

8. The method of claim 2, wherein the at least one value characterizing the regular background portion of the correlation function is dynamically determined.

9. The method of claim 8, wherein dynamically determining the at least one value characterizing the regular background portion of the correlation function comprises:

auto-correlating at least one representative image to generate at least a representative portion of the regular background portion of the auto-correlation function of that image; and

determining, based on at least the representative portion of the regular background portion of that auto-correlation function, the at least one value characterizing the regular background portion of the correlation function.

10. The method of claim 9, wherein the representative image comprises one of the first and second high-spatial-frequency images and a previously-selected typical high-spatial-frequency image.

11. The method of claim 8, wherein dynamically determining the at least one value characterizing the regular background portion of the correlation function comprises:

correlating a pair of images that are representative of the first and second high-spatial-frequency images to generate at least a representative portion of the regular background portion of the correlation function of that image; and

determining, based on at least the representative portion of the regular background portion of that correlation function, the at least one value characterizing the regular background portion of the correlation function.

12. The method of claim 1, wherein:

the peak portion of the correlation function has a width; and

the correlation function value points of the set of sparsely distributed correlation function value points are spaced apart by a distance that is less than the width of the peak portion of the correlation function.

13. The method of claim 1, wherein the set of sparsely distributed correlation function value points corresponds to one of a predetermined set of relative offset positions between the first and second images, a predetermined sequence of relative offset positions between the first and second images, a dynamically determined set of relative offset positions between the first and second images, and a dynamically determined sequence of relative offset positions between the first and second images.

14. The method of claim 13, wherein dynamically determining the set of relative offset positions between the first and second images comprises:

determining a width for the peak portion of the correlation function; and

selecting members of the set of sparsely distributed correlation function value points such that the members are spaced apart by a distance that is less than the determined width for the peak portion of the correlation function.

15. The method of claim 14, wherein determining the width for the peak portion of the correlation function comprises:

auto-correlating one of the first and second images to generate an auto-correlation function for that one of the first and second images; and

determining a width of a peak portion of the auto-correlation function; and

using the determined width of the peak portion of the auto-correlation function as the width for the peak portion of the correlation function.

16. The method of claim 15, wherein generating the auto-correlation function for that one of the first and second images comprises generating the auto-correlation function only in a region around a zero offset position for the auto-correlation image.

17. The method of claim 14, wherein determining the width for the peak portion of the correlation function comprises:

determining a width of a peak portion of a second correlation function for a pair of images that are representative of the first and second images; and

using the determined width of the peak portion of the second correlation function as the width for the peak portion of the correlation function.

18. The method of claim 13, wherein the predetermined sequence of relative offset positions between the first and second images comprises a binary search sequence.

19. The method of claim 13, wherein the predetermined sequence of relative offset positions between the first and second images comprises a first partial sequence of coarsely distributed relative offset positions followed a second partial sequence which one of offsets the first partial sequence and subdivides the first partial sequence.

20. The method of claim 13, wherein the predetermined sequence of relative offset positions between the first and second images comprises a search sequence of an ordered list of offset positions.

21. The method of claim 1, further comprising

comparing the first high-spatial-frequency image to the second high-spatial-frequency image to determine a plurality of additional correlation function values for a further set of densely distributed correlation function value points of the correlation function in the vicinity of the at least one correlation function value point that lies within the peak portion, the further set of correlation function value points densely distributed within at least a region of the peak portion; and

determining the location of the peak of the correlation function based on at least some of the additional correlation function value points.

22. The method of claim 21, wherein the at least one correlation function value point that lies within the peak portion comprises at least two correlation function value points, and the plurality of additional correlation function values for the further set of densely distributed correlation function value points is determined at least in the vicinity of the one of the at least two correlation function value points that has the correlation function value closest to the extremum of the correlation function.

23. The method of claim 1, wherein the comparing step comprises

determining a first at least one correlation function value for a set of at least one sparsely distributed correlation function value point in a first iteration, analyzing a first value based on that first member in the first iteration to determine if the corresponding correlation function value point lies within the peak portion;

determining if a predetermined halt condition is satisfied; and

repeating the comparing and analyzing steps in additional iterations if the predetermined halt condition is not satisfied.

24. The method of claim 23, wherein determining if the predetermined halt condition is satisfied comprises determining if one correlation function value point has been determined to lie within the peak portion

25. The method of claim 23, wherein determining if the predetermined halt condition is satisfied comprises:

determining, during an iteration, if a corresponding correlation function value point has been determined to lie inside the peak portion and has a more extreme correlation function value than that of any previous iteration; and

determining, during a next iteration, that the corresponding correlation function value is less extreme than the previously-determined more extreme correlation function value.

26. The method of claim 23, wherein determining if the predetermined halt condition is satisfied comprises:

determining when a corresponding correlation function value point has been determined to lie outside the peak portion during a relatively earlier iteration;

determining, in at least one relatively later iteration, if a corresponding correlation function value point has been determined to lie inside the peak portion; and

determining, in a relatively last iteration, if a corresponding correlation function value point has been determined to lie outside the peak portion.

27. The method of claim 1, further comprising determining the location of the peak of the correlation function based on at least one correlation function value point that lies within the peak portion.

28. The method of claim 27, further comprising determining a position offset between the first and second images based on the determined location of the peak of the correlation function.

29. The method of claim 1, further comprising obtaining the first and second images using an image-correlation optical position transducer having a readhead that is movable relative to a member having an image-determining surface.

30. The method of claim 1, further comprising obtaining the first and second images using an image-correlation optical position transducer having a readhead that is movable relative to a member having an image-determining surface.

31. The method of claim 1, wherein the image correlation function is a one-dimensional image correlation function.

32. The method of claim 1, wherein the image correlation function is a two-dimensional image correlation function.

33. An image-correlation-based displacement measuring system, usable to measure displacement relative to a member having an image-determining surface, the image-correlation-based displacement measuring system comprising:

a readhead comprising;

a sensing device that receives light reflected from the image-determining surface, the sensing device comprising a plurality of image elements that are sensitive to the reflected light, the plurality of image elements being spaced apart along at least a first direction, the image elements spaced along the first direction at a predetermined spacing, the predetermined spacing usable to determine the spatial translation of an image on the readhead, the spatial translation of the image on the readhead usable to determine the relative displacement of the readhead and the image-determining surface along a predetermined direction,

a light detector interface circuit connected to the sensing device, the light detector interface circuitry outputting signal values from the image elements of the sensing device, the signal values representative of image intensities of the reflected light on those image elements, and

a signal generating and processing circuitry element connected to the light detector interface circuit of the readhead;

wherein:

the light reflected from the image-determining surface creates an intensity pattern on the plurality of image elements based on the relative position of the image-determining surface and the readhead;

the light detector interface circuitry outputs a signal value from at least some of the plurality of image elements, the signal values together comprising an image;

the signal generating and processing circuitry element inputs a first image corresponding to a first relative position of the image-determining surface and the readhead and stores a representation of the image;

the signal generating and processing circuitry element inputs a second image corresponding to a second relative position of the image-determining surface and the readhead;

the signal generating and processing circuitry element, based on the first and second images, obtains correlation function values for at least one of a first set of correlation function value points that are sparsely distributed within a correlation function space of a correlation function having a regular background portion and a peak portion;

the signal generating and processing circuitry element analyzes a value of at least one correlation function value point of the first set to identify at least one correlation function value point of the first set of correlation function value points that lies within the peak portion;

the signal generating and processing circuitry element, based on the first and second images, obtains correlation function values for at least one of a second set of correlation function value points, the correlation function value points of the second set selected based on at least one of the at least one correlation function value point of the first set of correlation function value points that lies within the peak portion, the second set of correlation function value points densely distributed within at least a region of the peak portion; and

the signal generating and processing circuitry element determines the location of the peak of the correlation function based on at least some of the second set of correlation function value points.

34. An image-correlation-based displacement measuring system of claim 34 wherein the signal generating and processing circuitry is included in the readhead.

35. A recording medium that stores a control program, the control program executable on a computing device usable to receive data corresponding to a first high-spatial-frequency image and a second high-spatial-frequency image suitable for determining a correlation function having a regular background portion and a peak portion, the control program including instructions comprising:

instructions for comparing a first high-spatial-frequency image to a second high-spatial-frequency image to determine at least one correlation function value for a set of at least one sparsely distributed correlation function value point of the correlation function; and

instructions for analyzing at least one of the at least one correlation function value to identify at least one correlation function value point that lies within the peak portion.

36. A carrier wave encoded to transmit a control program, the control program executable on a computing device usable to receive data corresponding to a first high-spatial-frequency image and a second high-spatial-frequency image suitable for determining a correlation function having a regular background portion and a peak portion, the control program including instructions comprising::

instructions for comparing a first high-spatial-frequency image to a second high-spatial-frequency image to determine at least one correlation function value for a set of at least one sparsely distributed correlation function value point of the correlation function; and

instructions for analyzing at least one of the at least one correlation function value to identify at least one correlation function value point that lies within the peak portion.